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(54) Schmiermittel und seine Verwendung.

(57) Offenbart wird ein Schmiermittel auf Basis von Aminen und gegebenenfalls üblichen Verdünnungsmitteln oder Hilfs- bzw. Zusatzstoffen, welches mindestens ein sekundäres und/oder tertiäres Amin und/oder Salze derartiger Amine enthält, wobei der Anteil der Amine an der Gesamtformulierung 1 bis 100 Gew.-% beträgt. Derartige Schmiermittel werden vorzugsweise als Kettengleitmittel in der Lebensmittelindustrie, insbesondere für automatische Ketten- und Bandschmieranlagen, verwendet.



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TRANSLATION

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Title: Lubricant and Its Use

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ABSTRACT

Taught is a lubricant on the basis of amines and, as the case may be, usual dilutants or additives containing at least a secondary and/or tertiary amine and/or salts of such amines, the share of amines in the overall formulation amounting to 1-100% wt. Lubricants of that type are preferably used as chain lubricants in the foodstuff industry, specifically for automatic chain and conveyer lubrication systems.

SPECIFICATION

The present invention concerns a lubricant on the basis of amines and, as the case may be, usual dilutants or additives, which lubricant contains at least a secondary and/or tertiary amine and/or salts of such amines. Moreover, the invention concerns the use of such lubricants as chain lubricants in the foodstuff industry. The inventional lubricants are used specifically for lubricating, cleaning and disinfecting automatic chain and conveyer lubrication systems such as used in the packaging of foodstuffs, preferably beverages, in glass and plastic bottles, jars, glasses, barrels, beverage containers (KEG), paper and cardboard containers and similar.

In bottle and keg cellars of beverage facilities as well as in the packaging of foodstuffs, plate conveyers or other conveyer systems are customarily used for transporting the respective containers, which systems are lubricated and kept clean using suitable aqueous lubricant preparations in dip lubrication systems or, recently, also automatic conveyer lubrication systems.

While dip lubrication systems hardly pose problems as regards the applicational properties when selecting the lubricant, precipitations of salts that are difficult to dissolve and microbiological deposits in the nozzles and filters of the central lubrication systems can considerably interfere with the continuous operation in packaging foodstuffs, specifically bever-

ages, so that the systems always need to be shut down and cleaned after a certain period of operation.

The chain sliding agents used so far as lubricants are based, for one, on fatty acids in the form of water-soluble alkali or alkanolamine salts or on fatty amines in the form of their organic or inorganic salts.

While both substance classes are nonproblematic in their use for dip lubrication, they display in today's customary central chain lubrication systems a number of disadvantages. For instance, the German patent disclosure 23 13 330 describes lubricants on soap basis that contain aqueous mixtures of $C_{??}$-$C_{??}$ fatty acid salts and surface active substances. Such lubricants on soap basis are associated with the following disadvantages:

1. A reaction with the water hardness occurs, i.e., with the earth alkali ions and other substances contained in the water, under formation of metal soaps of low solubility, the so-called primary earth alkali soaps.
2. A reaction occurs between these lubricants on soap basis and carbon dioxide dissolved in water or the goods being bottled.
3. The application solution so produced will always stimulate germination.
4. The use of hard water requires ion exchangers, as additional germ source, or the utilization of products containing complexing agents, which again is questionable in terms of ecology.

5. There is increased foaming, causing problems specifically on the bottle inspector (automatic bottle check) and resulting possibly in the penetration of these lubricants in the container used for shipping.
6. Most of these products contain solvents.
7. The cleaning effect of these products is poor, requiring always a separate, discontinuous cleaning.
8. Such lubricant preparations on soap basis display a pH-dependent performance.
9. Lubricant preparations on soap basis, furthermore, display a contingence on water temperature.
10. Lubricants on soap basis show only a low storage stability, specifically at low temperatures.
11. Contained in many products, EDTA (ethylenediaminetetraacetate) is difficult to degrade biologically, as is commonly known.
12. Such lubricant preparations on soap basis are not suited for all transport goods made of plastic, since the application of these agents causes in many cases tension crack corrosions.

In addition to these lubricants on soap basis, such on the basis of primary fatty amines are primarily used. For instance, the German patent disclosure 38 31 953 describes a process for lubricating chain type bottle conveyers in beverage bottling plants, specifically in breweries, and for cleaning the conveyers by means of a liquid cleanser, which process is characterized in that the chain type bottle conveyers are lubricated using lubricants on

the basis of neutralized primary fatty amines that contain preferably 12 to 18 C-atoms and have an unsaturated share of more than 10%, and in that the bottle conveyers are cleaned using cationic cleaners, namely quaternary ammonium compounds such as chlorides of aklylmethyl ammonium, dialkylmethyl ammonium and alkyldimethyl benzylammonium or organic acids.

The major disadvantages of this process are:

1. The reaction with anions of the water, specifically with sulfates, dicarbonates, phosphates and carbonates from alkaline waters as well as other ingredients of water.
2. A strong reaction with carbonic acid dissolved in water, forming low-solubility ammonium carbonates, for instance in beverages containing carbonic acid.
3. Solvents need to be used of necessity.
4. The spray and distribution system needs to be cleaned periodically, since otherwise the entire system will clog and become useless.
5. In the case of lubricants on the basis of primary fatty amines, a continuous 24-hour operation is not possible.
6. Using corrosion-stimulating and caustic acids for system cleaning leads to corrosion damage to the spray system components, which partly consist of chrome steel or nonferrous metals.
7. The periodic cleaning of the spray and distribution system necessitates always high equipment expense.
8. When using such primary fatty amines as lubricants, the systems can be run at an only low flexibility, and the application of this

process is ruled out in many cases, since existing systems often comprise premix containers.

9. The use of primary fatty amines and the two process steps required for it — for one lubrication, for another cleaning — necessitate high investments in equipment.

10. Lastly, the use of primary amines and other low alkyl acids, such as acetic acid, which are required for the cleaning phase, is associated also with a considerable accrual of odors.

Major disadvantages of the above processes, for one, are thus the heavy water dependence of the lubricants on soap basis and the periodically necessary system cleaning when using lubricants on the basis of primary amines. The precipitations occurring in both processes of the prior art must be removed. A simple acid base reaction is used for their removal, using in the case of soap products on fatty acid basis for that purpose alkaline cleaners containing complexing agents, and as technical equivalents, in the case of products based on primary fatty amines, organic or inorganic acids as cleaners.

Lastly, there are other chain lubricants known from the prior art which are not associated with the disadvantages illustrated above. For instance, the European patent document 0 044 458 describes lubricant preparations that are practically free of fatty acid soaps and which, additionally, contain a carboxylated nonionic tenside and an acylsarcosinal. The pH of these

products amounts to 7-11 and lies thus preferably in the neutral to alkaline range.

The German patent application P 38 31 448.7 (unpublished), lastly, concerns aqueous, clear-water-soluble, soapless lubricant preparations, a process for their manufacture and the use of the inventional lubricant preparations, specifically as a lubricant in conveying glass bottles or polyethylene terephthalate bottles. The essentially neutral, aqueous lubricant preparation (pH ranging from 6 to 8) contains alkylbenzol sulfonates, alkoxylated alkanol phosphates and alkanocarbonic acids, facultatively in addition to usual intermediaries of solution, solvents, antifrothants and disinfectants.

However, also these two products described above still have the following three disadvantages:

1. They are microbiologically unfavorable, since they provide outstanding growth conditions for microorganisms.
2. Furthermore, they display only a low cleansing effect.
3. Lastly, they display a frothing performance that is difficult to manage.

The problem underlying the present invention now is to provide a new lubricant preparation, specifically a chain lubricant, which is not affected by the disadvantages of the prior art, that is, such solvents are to possess both a good coefficient of friction, that is, an outstanding

lubrication effect, low frothing, a good cleaning effect and a good microbicidal effect.

This problem is solved through the inventional lubricants, which contain at least one secondary and/or tertiary amine and/or salts of such amines.

Surprisingly, the inventional lubricants do not display the disadvantages that are associated with lubricants based on primary fatty amines. This is the more unexpected as secondary and tertiary amines usually display only gradual differences as compared to the properties of primary amines.

The present invention thus concerns a lubricant on the basis of amines and, as the case may be, usual dilutants or additives, characterized in that it contains at least a secondary and/or tertiary amine and/or a salt of such amines, the share of the amines in the overall formulation amounting to 1-100% wt.

These lubricants display in the form of their watery solutions either a clear solubility or opalescence.

Regarding their applicational properties, the inventional lubricants display a good coefficient of friction, a low frothing and a good cleaning effect as well as good microbicidal properties.

According to one embodiment of the present invention, the solvent contains at least a secondary amine of the general formula (Ia) or (Ib)

$R\text{-}NH\text{-}R^1$ (Ia)

$R\text{-}N^{\oplus}Hz\text{-}R^1\ X^{\ominus}$ (Ib)

where the residues R and $R^1$, always independently from each other, have the following meaning:

- a substituted or unsubstituted, linear or ramified, saturated or single or multiple unsaturated alkyl residue with 6 to 22 C-atoms, which as substituent may contain at least an amine, imine, hydroxy, halogen or carboxy residue,
- a substituted or unsubstituted phenyl residue which as substituents may comprise at least an amine, imine, hydroxy, halogen, carboxy and/or a linear or ramified, saturated or single or multiple unsaturated alkyl residue with 6-22 C-atoms,

and $X^{\ominus}$ means an anion from the group of amidosulfonate, nitrate, halogenide, sulfate, hydrogen carbonate, carbonate, phosphate or $R^2\text{-}COO$,

while the residue $R^2$ stands for

- hydrogen,
- a substituted or unsubstituted, linear or ramified alkyl residue with 1-20 C-atoms or alkenyl residue with 2-20 C-atoms which as substituents may comprise at least a hydroxy, amine or imine residue or
- a substituted or unsubstituted phenyl residue which as substituent may contain an alkyl residue with 1-20 C-atoms.

Thus, in the above general formulas (Ia) and (Ib) the following residues are applicable as substituents R and $R^1$: n-hexyl, n-haptyl, n-octyl, n-nonyl, n-decyl, n-undecyl, n-dodecyl, n-tridecyl, n-tetradecyl, n-pentadecyl, n-hexadecyl, n-heptadecyl, n-octadecyl, n-nonadecyl, n-eicosyl, n-uneicosyl and n-docosyl, as well as the ramified isomers of the above alkyl residues. Instead of the saturated alkyl residues, R and $R^1$ may also be the corresponding — single or multiple — unsaturated alkyl residues, which may as well be linear or ramified. The aforementioned residues may be substituted, with one or several amine, imine, hydroxy, halogen or carboxy groups being applicable as substituents. Moreover, the residues R and $R^1$ may also mean phenyl residues which at the same time may be substituted with one or several amine, imine, hydroxy, halogen or carboxy groups. Usable for R and $R^1$ are also alkyl phenyl residues, where the alkyl residue contains 6-22 C-atoms and may at the same time be linear or ramified, saturated or single or multiple unsaturated. The halogen substituents are in all cases chlorine or bromium.

Cited as examples for secondary amines of the type of the general formula (Ia) that are used in the framework of the present invention are: dicoconut oil alkylamine, distearyl amine, and ditallow alkylamine.

Applicable as anion $X^-$ — in addition to the inorganic anions cited above — are also anions of organic acids of the type $R^2$-COO. Here, the residue $R^2$ may also mean hydrogen and low alkyl or alkaline residues, while otherwise the above explanations on R and $R^1$ apply analogously.

Named as examples for organic ions $X^-$ of the type $R^2$-$COO^-$ are: formiate, acetate, oleate, glycolate, lactate, gluconate, benzoate and salicylate.

Applicable as examples for secondary amines of the type of the general formula (Ib), which are as well preferred in conjunction with the present invention are the above compounds of the type of the general formula (Ia) in the form of their salts, with the aforenamed organic anions.

According to another embodiment of the present invention, the lubricant contains at least a secondary diamine of the general formulas (IIa), (IIb), or (IIc)

$R\text{-}NH\text{-}(CH_2)_2NH_2$ (IIa)

$R\text{-}NH\text{-}(CH_2)_2N^-H_2\ X^-$ (IIb)

$R\text{-}N^-H_2\text{-}(CH_2)_2\text{-}N^-H_2\ 2X^-$ (IIc)

where the residues R and $X^-$ have the meanings stated above for the general formulas (Ia) and (Ib).

As examples for secondary diamines of the type of the general formulas (IIa), (IIb) and (IIc) as preferred in the context of the present invention there are named: n-laurylpropylene diamine and N-tallow alkylpropylene diamine, always in the form of the free amines and in the form of the acetate salts.

According to a third embodiment of the present invention, the lubricant contains at least one tertiary amine of the general formulas (IIIa) and (IIIb)

$R\text{-}NR^3\text{-}R^4$ (IIIa)

$R\text{-}N^-HR^3R^4\ X^-$ (IIIb)

where the residues R and X have the meanings stated for the general formulas (Ia) and (Ib) while the residues $R^2$ and $R^4$, always independently of each other, mean:

- a substituted or unsubstituted, linear or ramified alkyl residue with 1 to 20 C-atoms or alkenyl residue with 2 to 20 C-atoms which as substituents may possess at least one hydroxy, amine or imine residue or
- a substituted or unsubstituted phenyl residue which as substituent may comprise an alkyl residue with 1-20 C-atoms.

Applicable to the residues $R^3$ and $R^4$ are analogously again those explanations which above were given in the context of the residues R and $R^2$.

As examples for the tertiary amines of the type of the general formulas (IIa) and (IIb) that are preferred in the framework of the present invention there are named: N,N-dipropyl-N-laurylamine and the corresponding acetate salt.

In the framework of this third embodiment, the lubricant preferably contains at least one tertiary amine of the general formulas (IVa) or (IVb)

$R\text{-}N(CH_2)_2$ (IVa)

$R\text{-}N^{-}H(CH_2)_2\ X^{-}$ (IVb)

where the residues R and $X^{-}$ each have the meaning stated for the general formulas (Ia) and (Ib).

Named as examples for tertiary amines of the type of the general formulas (IVa) and (IVb), which are as well preferred in the framework of the invention, are: N,N-dimethyl-N-laurylamine, N,N-dimethyl-N-hexadecyl amine, N,N-dimethyl-N-coconut oil alkylamine, N,N-dimethyl-N-cetyl amine and the corresponding acetate salts.

Secondary and tertiary amines corresponding to the above general formulas can be produced according to methods known from the literature and, incidentally, are partly also available as commercial products, for instance from the firm Hoechst AG, Frankfurt am Main, Germany, under the designation GENAMIN$^{R}$, or from the firm Lonza, Basel, Switzerland, under the designation LONZABAC$^{R}$ 12.

According to a preferred embodiment of the present invention, the lubricants contain secondary and/or tertiary amines of the above general formulas (Ia) through (IVb) where the residues R, $R^1$, $R^2$, $R^3$, $R^4$, and $X^{-}$ have the following meanings:

- R and $R^1$ each stand independently for a linear or ramified, saturated or single or multiple unsaturated alkyl residue with 12 to 18 C-atoms,

- $R^3$ and $R^4$ each stand independently for a linear or ramified alkyl residue with 1 to 6 C-atoms or alkenyl residue with 2-6 C-atoms,
- $X^-$ stands for the residue $R^2$-$COO^-$, where $R^2$ means hydrogen, $CH_2$, HO-$CH_2$ or $CH_2$-CH(OH).

Moreover, the invention prefers lubricants containing
5 to 40% wt., specifically 10 to 20% wt., of secondary and/or tertiary amines and/or salts of such amines, as well as
95 to 60% wt., specifically 90 to 80% wt., of water as dilutant and, as the case may be, adjuvant substances or additives,
always based on the overall formulation.

Usable as adjuvants and/or additives in the sense of the present invention are specifically dissolving intermediaries, for instance alcohols, polyalcohols, ether or polyether, specifically isopropanol, butylglykol, butyldiglykol or ethyleneglykolether. The amount of dissolving intermediary to be used depends on the presently contained amine, and the expert will determine the necessary amount of dissolving intermediary by experimentation. In general, additives to dissolving intermediaries are sufficient in the range of 5-20% wt. based on the overall formulation.

Applicable as adjuvants and/or additives in the sense of the present invention, moreover, are specifically nonionic and/or anionic tensides, for instance alkoxylated fatty amines, fatty alcohols, alkoxylated fatty alcohols and alkylbenzol sulfonates which are soluble in hydrophilic solvents. These tensides are capable of improving the wetting of the chains

and plate conveyers, should this be required individually. Tenside additions in the range of 5-10% wt., based on the overall formulation, are generally sufficient for that purpose.

The inventional lubricants have preferably a pH ranging from 4 to 11, specifically from 5 to 8. If the pH value of the lubricant is not already in this range, it can be adjusted to the desired value by addition of an acid, preferably an acid with the anion $X^-$ as defined above, for instance acetic acid or formic acid.

Inventionally, the lubricants also have preferably a dynamic viscosity of less than 300 mPa.s, specifically of less than 150 mPa.s, and with particular preference in the range of 20 to 100 mPa.s — always at 20°C. A specific adjustment of the viscosity to the above values is generally not required or, as the case may be, is effected by addition of suitable quantities of the dilutant water or of a dissolving intermediary.

The inventional lubricants can be produced by simple mixing of the amine components, facultatively under addition of water and of the above adjuvants or additives.

According to a particularly preferred embodiment of the present invention, the lubricants contain:

a) 2-10% wt. of a secondary amine of the general formulas (IIb) and/or (IIc),

b) 2-10% wt. of a tertiary amine of the general formulas (IIb) and/or (IVb),

c) residue: water and facultatively adjuvants or additives, with the components a and b being present at a weight ratio of a : b equaling 1 : 2 through 3 : 1, preferably 2 : 1. Such a combination proves to be particularly effective in view of lubrication effect and inhibition of frothing. As an example of such a combination, reference is made to the following example 8.

Lastly, the present invention concerns the use of lubricants of the type described above as chain lubricant in the foodstuff industry, specifically for automatic chain and conveyer lubrication systems. The present invention concerns particularly the use of the lubricants described above in the form of a 5-40% wt., preferably 1-10% wt. aqueous solution as a chain lubricating agent for automatic chain and conveyer lubrication systems.

Moreover, however, the inventional lubricants may advantageously be used also as so-called cutting oils or coolants in the machining of metal.

Unlike standard soap products, the inventional products do not cause any tension crack corrosion and, therefore, can be utilized nonproblematically for PET and PC containers. (PET = polyethylene terephthalate, PC = polycar-

bonate). Especially preferred for clear-water-soluble concentrates are pH values of < 8.5.

An additional benefit can be achieved with this product and process in conjunction with conveyers in the foodstuff industry. When at the end of the production replacing the lubricant by a cleaning agent on the basis of organic or inorganic acids and continuing to run the conveyer facilities, i.e., chains or conveyer belts, as the acid is distributed, a creamy foam will form on the belts and at spots which otherwise are accessible only with difficulty. Subsequent to a sufficient dwell, the foam can be rinsed away with water with the aid of the same system. Owing to this automatic process, the manual "foaming" and rinsing with low-pressure, medium-pressure and high-pressure foaming apparatuses, which otherwise is frequently performed periodically by hand, can be dispensed with.

Examples

The present invention will be more fully explained with the aid of the following examples. The inventional examples 1 through 4 and 8 through 17 illustrate the frictional resistance and the foaming behavior of inventional lubricant formulations. Examples 5 through 7 show the good microbicidal effectiveness of the inventional lubricant formulations. Examples 1 through 8, concerning prior art products, serve comparison purposes.

All of the percentage references in the following formulation examples are weight percentages.

The tests for measurement of the frictional resistance, hereafter briefly referred to as "friction value," were performed on a "Technikum" bottle conveyer under the following conditions:

Measurement of the frictional resistance of 20 0.5-l Euro beer bottles filled with water, as tension load, using a dynamometer.

Bottle conveyer speed: about 1 m/s

Spraying the bottle conveyer belt with 0.3% conveyer lubricant solution.

Cycle times: 20 s spraying/20 s pause.

Spray capacity of the nozzles: 5 l/h.

The friction value "$\mu$" stated hereafter derives as the quotient of the measured tension for a bottle to the weight of the bottle in grams.

Moreover, the products were tested with hard water (16 d) according to the provisions of DIN 53 902.

The foaming behavior is graded according to the following classes:

0 = no foam

1 = sporadic foam bubbles

2 = slight foaming, not disturbing

3 = foaming, disturbing

4 = heavy foaming, not acceptable, foam underneath the conveyer.

Example 1:

15% laurylpropylene diamine, 85% water, friction value: $\mu$ = 0.11, foaming behavior = 1-2

Example 2:

15% laurylpropylene diamine ammonium acetate, 85% water, friction value: $\mu$ = 0.11, foaming behavior = 1-2

Example 3:

15% N-N-dipropyl-N-laurylamine, 85% water, friction value: $\mu$ = 0.13, foaming behavior = 2

Example 4:

15% N-N-dipropyl-N-lauryl ammonium acetate, 85% water, friction value: $\mu$ = 0.13, foaming behavior = 1-2

Comparative Example 1:

(Soap product according to DE-OS 23 13 330)

14% fatty acid with a chain distribution of 18% C 14-18, 25% C-18', 48% C-18'', 7% C-18''', and 2% C-20

4% KOH, 12% triethanolamine, 15% dodecylbenzosulfonate triethanolamine salt, 3% ethylenediamine-30EO-60PO, 1% oleyl cetylalcohol, 3% monoethanolamine, 2% ethylenediamine tetraacetate (EDTA), 5% isopropanol, 41% water, friction value: $\mu$ = 0.11, foaming behavior = 4

Comparative Example 2:

(Fatty amine product according to DE-OS 36 31 953)

18% acetic acid, 50% cocosarcine, 11% triethanolamine, 5% nonylphenol-10-EO, 16% water, friction value: $\mu$ = 0.09, foaming behavior = 0

Comparative Example 3:

(Soapless products according to the German patent application P 36 31 448.7)

12% $C_{12}?_{10}$ fatty alcohol-10-EO-phosphate, 9% dodecylsulfonate, 10% urea, 10% isopropanol, 59% water, friction value: $\mu$ = 0.15, foaming behavior = 2

In the above comparative examples, EO = ethylene oxide, PO = propylene oxide.

The cleaning effect of the products on the conveyers can visually be assessed as good for the examples 1, 2, 3 and 4, but as insufficient for the comparative examples 1 and 3.

All of the lubricants presented are suited for commercial use, since the friction value is $\mu < 0.15$.

Disinfectant Effect

The inventional lubricants display a distinctly good microbicidal effectiveness, as will be shown with the aid of the suspension tests performed according to DVG (German Association for Veterinary Medicine):

Example 5:

Lauryl-propylenediamine (15% wt. in water) according to example 1

| Test strains | Number of germs | Germ destruction times in minutes at 20°C, concentration in % | | | |
|---|---|---|---|---|---|
| | | 0.07 | 0.33 | 0.66 | 1.67 |
| Staphylococcus aureus K 3212 | $4 \times 10^7$ | 5 | 5 | 5 | 5 |
| Streptococcus laecium K 3343 | $5 \times 10^7$ | 5 | 5 | 5 | 5 |
| Proteus mirabilis K 2910 | $5 \times 10^7$ | 5 | 5 | 5 | 5 |
| Pseudomonas K 1111 | $1 \times 10^7$ | 15 | 5 | 5 | 5 |
| Escherichia Coli K 2114 | $6 \times 10^7$ | 15 | 5 | 5 | 5 |
| Candida albicans K 6710 | $1 \times 10^7$ | 15 | 5 | 5 | 5 |

Example 6:

Lauryl-propylene diammoniumacetate (15% wt. in water) according to example 2

| Test strains | Number of germs | Germ destruction times in minutes at 20°C, concentration in % | | | |
|---|---|---|---|---|---|
| | | 0.07 | 0.33 | 0.66 | 1.67 |
| Staphylococcus aureus K 3212 | $8 \times 10^7$ | 5 | 5 | 5 | 5 |
| Streptococcus laecium K 3343 | $6 \times 10^7$ | 5 | 5 | 5 | 5 |
| Proteus mirabilis K 2910 | $1 \times 10^7$ | 5 | 5 | 5 | 5 |
| Pseudomonas K 1111 | $8 \times 10^7$ | 5 | 5 | 5 | 5 |
| Escherichia Coli K 2114 | $4 \times 10^7$ | 5 | 5 | 5 | 5 |
| Candida albicans K 6710 | $3 \times 10^7$ | 5 | 5 | 5 | 5 |

Example 7:

N,N-dipropyl-N-laurylamine (15% wt. in water) according to example 3

Qualitative DGHM test (German Association for Hygiene and Microbiology) 20°C

| Test germ | Germ density | Concentration | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.33 | | | | 0.066 | | | | 0.033 | | | | 0.0066 | | | |
| | | Time | | | | | | | | | | | | | | | |
| | | 5' | 15' | 30' | 60' | 5' | 15' | 30' | 60' | 5' | 15' | 30' | 60' | 5' | 15' | 30' | 60' |
| Pseudom K 1111 | 3 x $10^7$ | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + |
| Esch.C K 2114 | 2 x $10^7$ | - | - | - | - | - | - | - | - | + | + | + | - | + | + | + | + |
| Staph illeg. | 2.5 x $10^7$ | - | - | - | - | + | + | - | - | + | + | + | + | + | + | + | + |
| illeg. | 1 x $10^7$ | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + |
| Cand. alb. | 1 x $10^7$ | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | - |

Comparative Example 4:

(Composition, refer to comparative example 1)

| Test strains | Number of germs | Germ destruction times in minutes at 20°C, concentration 0.33% |
|---|---|---|
| Pseudomonas K 111 | 3 x $10^7$ | > 60 |
| Escherichia Coli K 2114 | 2 x $10^7$ | > 60 |
| Klebsiella aerogenes K 2530 | 5 x $10^7$ | > 60 |
| Lactobacillus brevis K 4111 | 4 x $10^7$ | > 60 |
| Saccharomyces cerev. K 5011 | 3 x $10^7$ | > 60 |
| Hansonula anomala K 5411 | 5 x $10^7$ | > 60 |
| Aspergillus niger K 7441 | 9 x $10^7$ | > 60 |

Comparative Example 5:

(Composition, refer to comparative example 2)

Suspension test according to DLG (German Foodstuffs Association) at 20°C

| Test strains | Number of germs | Germ destruction times in minutes at 20°C, concentration 0.3% |
|---|---|---|
| Pseudomonas K 111 | $3 \times 10^7$ | 1 |
| Escherichia Coli K 2114 | $2 \times 10^7$ | 1 |
| Klebsiella aerogenes K 2530 | $5 \times 10^7$ | 1 |
| Lactobacillus brevis K 4111 | $4 \times 10^7$ | 1 |
| Saccharomyces cerev. K 5011 | $3 \times 10^7$ | 2.5 |
| Hansonula anomala K 5411 | $5 \times 10^7$ | 10 |
| Aspergillus niger K 7441 | $9 \times 10^7$ | 20 |

Comparative Example 6:

(Composition, refer to comparative example 3)

| Test strains | Number of germs | Germ destruction times in minutes at 20°C, concentration 0.3% |
|---|---|---|
| Pseudomonas K 111 | $3 \times 10^7$ | > 60 |
| Escherichia Coli K 2114 | $2 \times 10^7$ | > 60 |
| Klebsiella aerogenes K 2530 | $5 \times 10^7$ | > 60 |
| Lactobacillus brevis K 4111 | $4 \times 10^7$ | > 60 |
| Saccharomyces cerev. K 5011 | $3 \times 10^7$ | > 60 |
| Hansonula anomala K 5411 | $5 \times 10^7$ | > 60 |
| Aspergillus niger K 7441 | $9 \times 10^7$ | > 60 |

These values show that the inventional lubricants are capable of combining the advantages of the soapless lubricants (independent of water quality) with those of the lubricants based on primary amines (cleaning and disinfection). The disadvantages, specifically the regular removal of depositions, can be prevented with these inventional lubricants.

Example 8:

10% lauryl-propylene diammonium acetate, 5% N,N-dimethyl-N-cetylammonium acetate, 85% water, friction value: $\mu$ = 0.09, foaming behavior = 0

Example 9:

8% lauryl-propylene diammonium acetate, 4% N,N-dipropyl-N-laurylammonium acetate, 88% water, friction value: $\mu$ = 0.12, foaming behavior = 2-3

Example 10:

8% lauryl-propylene diammonium acetate, 4% N,N-dimethyl-N-laurylammonium acetate, 88% water, friction value: $\mu$ = 0.10, foaming behavior = 0-1

Example 11:

8% lauryl-propylene diammonium acetate, 4% N,N-dimethyl-N-coconut oil ammonium acetate, 80% water, friction value: $\mu$ = 0.11, foaming behavior = 1

Example 12:

8% lauryl-propylene diammonium acetate, 4% N,N-dimethyl-N-hexadecyl ammonium acetate, 88% water, friction value: $\mu$ = 0.11, foaming behavior = 0

Example 13:

8% lauryl-propylene diammonium acetate, 4% tallow propylene diammonium acetate, 88% water, friction value: $\mu$ = 0.11, foaming behavior = 2

Example 14:

8% N,N-dipropyl-N-laurylammonium acetate, 4% N,N-dimethyl-N-laurylammonium acetate, 88% water, friction value: $\mu$ = 0.12, foaming behavior = 1-2

Example 15:

8% N,N-dipropyl-N-laurylammonium acetate, 4% N,N-dimethyl-N-coconut oil ammonium acetate, 88% water, friction value: $\mu$ = 0.12, foaming behavior = 1-2

Example 16:

8% N,N-dipropyl-N-laurylammonium acetate, 4% N,N-dimethyl-N-hexadecyl ammonium acetate, 88% water, friction value: $\mu$ = 0.12, foaming behavior = 1

Example 17:

8% N,N-dipropyl-N-laurylammonium acetate, 4% tallow propylene diammonium acetate, 88% water, friction value: $\mu$ = 0.11, foaming behavior = 3

CLAIMS

1. Lubricant based on amines and, as the case may be, usual dilutants or adjuvants or additives, characterized in that it contains at least one secondary and/or tertiary amine and/or a salt of such amines, the share of amines in the overall formulation amounting to 1-100% wt.

2. Lubricant according to claim 1, characterized in that it contains at least one secondary amine of the general formula (Ia) or (Ib)

$R\text{-}NH\text{-}R^1$ (Ia)

$R\text{-}N^{\oplus}Hz\text{-}R^1\ X^{\ominus}$ (Ib)

where the residues R and $R^1$, each independently of each other, mean:

- a substituted or unsubstituted, linear or ramified, saturated or single or multiple unsaturated alkyl residue with 6-22 C-atoms, which as substituents may contain at least one amine, imine, hydroxy, halogen and/or carboxy residue,
- a substituted or unsubstituted phenyl residue which as substituents may comprise at least one amine, imine, hydroxy, halogen, carboxy and/or a linear or ramified, saturated or single or multiple unsaturated alkyl residue with 6-22 C-atoms,

and $X^{\ominus}$ means an anion of the group of amidosulfonate, nitrate, halogenide, sulfate, hydrogen carbonate, carbonate, phosphate or $R^2\text{-}COO^{\ominus}$

where the residue $R^2$ stands for

- hydrogen,

- a substituted or unsubstituted, linear or ramified alkyl residue with 1-20 C-atoms or an alkenyl residue with 2-20 C-atoms which as substituent may contain at least one hydroxy, amine or imine residue, or
- a substituted or unsubstituted phenyl residue which as substituent may contain an alkyl residue with 1-20 C-atoms.

3. Lubricant according to claim 1, characterized in that it contains at least one secondary diamine of the general formula (IIa), (IIb) or (IIc)

$R\text{-}NH\text{-}(CH_2)_2NH_2$ (IIa)

$R\text{-}NH\text{-}(CH_2)_2N^-H,\ X^-$ (IIb)

$R\text{-}N^-H_2\text{-}(CH_2)_2\text{-}N^-H_2\ 2X^-$ (IIc)

where the residues R and $X^-$ each have the meaning indicated for the general formulas (Ia) and (Ib).

4. Lubricant according to claim 1, characterized in that it contains at least one tertiary amine of the general formula (IIIa) or (IIIb)

$R\text{-}NR^3\text{-}R^4$ (IIIa)

$R\text{-}N^-HR^3R^4\ X^-$ (IIIb)

where the residues R and $X^-$ have the meaning indicated for the general formulas (Ia) and (Ib) and the residues $R^3$ and $R^4$, each independently of each other, mean:

- a substituted or unsubstituted, linear or ramified alkyl residue with 1-20 C-atoms or alkenyl residue with 2-20 C-atoms which as substituents may contain at least one hydroxy, amine or imine residue, or
- a substituted or unsubstituted phenyl residue which as substituents may contain an alkyl residue with 1-20 C-atoms.

5. Lubricant according to claim 4, characterized in that it contains at least a tertiary amine of the general formula (IVa) or (IVb)

$R\text{-}N(CH_2)_2$ (IVa)

$R\text{-}N^{-}H(CH_2)_2\ X^{-}$ (IVb)

where the residues R and $X^{-}$ have the meaning stated for the general formulas (Ia) and (Ib).

6. Lubricant according to one of the claims 1 through 5, characterized in that the residues R, $R^1$, $R^2$, $R^3$, $R^3$, $R^4$ and $X^{-}$ have in the general formulas the following meanings:

- R and $R^1$, independently of each other, stand for a linear or ramified, saturated or single or multiple unsaturated alkyl residue with 12-18 C-atoms,
- $R^3$ and $R^4$, independently of each other, stand for a linear or ramified alkyl residue with 1-6 C-atoms or alkenyl residue with 2-6 C-atoms,
- $X^{-}$ stands for the residue $R^2\text{-}COO^{-}$, where $R^2$ means hydrogen, $CH_2$, $HO\text{-}CH_2$ or $CH_2\text{-}CH(OH)$.

7. Lubricant according to one of the claims 1 through 6, characterized in that it contains
5-40% wt., specifically 10-20% wt. of amines and
95-60% wt., specifically 90-80% wt. water and/or adjuvants or additives, each based on the overall formulation.

8. Lubricant according to claim 7, characterized in that it contains dissolving stimulants as adjuvants or additives.

9. Lubricant according to claim 7, characterized in that it contains nonionic and/or anionic tensides as adjuvants or additives.

10. Lubricant according to one of the claims 1 through 9, characterized in that it has a pH value in the range of 4-11, preferably in the range of 5-8.

11. Lubricant according to one of the claims 1 through 9, characterized in that it has a dynamic viscosity of less than 300 Mpa.s, preferably in the range of 20-100 Mpa.s.

12. Lubricant according to one of the claims 1 through 11, characterized in that it contains

a) 2-10% wt. of a secondary amine of the general formulas (IIb) and/or (IIc),

b) 2-10% wt. of a tertiary amine of the general formulas (IIb) and/or (IVb),

c) residue: water and, as the case may be, adjuvants or additives, where the components a and b are available at a weight ratio of a to b as 1 : 2 through 3 : 1, preferably 2 : 1.

13. The use of the lubricant according to one of the claims 1 through 12 as a chain lubricating agent in the foodstuffs industry, specifically for automatic chain and conveyer lubrication systems.

Translator's Note:

Due to poor legibility of the German text, superscripts, subscripts and chemical names in this translation cannot be relied upon.